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UNITED STATES DEPARTMENT OF AGRICULTURE
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CURRENT DEPARTMENT RESEARCH ON
PACKAGING AND CONTAINERS
(as of July 1, 1952)

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Foreword:

This summary was developed through the joint efforts of representatives of each Department agency that conducts a significant amount of packaging research and the Office of the Research Administrator, ARA. It represents an attempt to show a brief but comprehensive picture of the current activity in this field. The first step in this effort was the compilation of a list of all the projects in the Central Project Files of the Department that mentioned packaging or closely related terms. Agency representatives then proceeded to amend this list so that it would be properly inclusive by appropriate additions and deletions. Later the group undertook the task of developing an outline of packaging research, which formed the basis for organization of the project descriptions herein listed.

The descriptive information on projects included in this summary is necessarily brief, and it does not provide a complete and exact picture of the nature and scope of individual projects. Because of the need for brevity, the summary is not an adequate basis for judging how well the efforts of Department persons and agencies are integrated. It is evident from the summary that there are many closely related projects currently underway in the Department, but the summary does not show the extent to which agencies are cooperating with each other through joint planning and exchange of information. Where further information on these questions is needed, inquiries should be directed to the particular agencies concerned.

Attention is called to the fact that this summary describes only the current program of the Department. It does not indicate the full extent and degree of balance that would characterize packaging research activities over a period of years.

C O N T E N T S

	<u>Pages</u>
I. Product Requirements and Container Development and Evaluation.	
A. Horticultural Products	1-15
B. Animal and Poultry Products	6, 7
C. Other Food and Feed Products	8, 9
D. Other Products	9
II. Development and Evaluation of Container Materials.	9, 10
III. Evaluation and Improvement of Packaging Operations.	10 - 12
IV. Other Investigations Relating to Production and Use of Containers.	12

I. PRODUCT REQUIREMENTS AND CONTAINER DEVELOPMENT AND EVALUATION

Research in this field includes: (1) determination of the basic container requirements of specific products, (2) evaluation of the functional characteristics of existing or newly developed containers, (3) development of containers to achieve functional objectives, (4) evaluation of container materials insofar as they relate to the requirements of particular products, and (4) evaluation and improvement of the preparation and handling of products to be packaged.

Determinations of the basic container requirements of products and the functional adaptation of containers to these requirements involve evaluations in terms of the functional purposes of the packages and containers; such purposes include: (1) preservation of product, (2) efficiency in transporting, storing and processing products, (3) trade and consumer acceptance, and (4) minimizing of marketing costs.

A. Horticultural Products

Prevention of losses in yield and quality from enzymatic browning in dehydration, concentration, and freezing of fruits. Deals in part with effect of composition of sirup and volume of air space in container on appearance and storage stability of frozen fruits, particularly peaches. (BAIC #4)

Determination of shelf-life of heat-processed (canned) Concord type grape juice concentrate from Western grapes under the range of temperature conditions encountered in military and civilian use. This is a sterile product and must be packed in hermetically sealed containers. Therefore, the effect of glass and metal containers on the product will be studied. (BAIC #5)

Development of processes for preparing strawberry juice and concentrates thereof from sound cull fruit to conserve essential food and reduce packing house waste. Deals in part with the effect of tin and/or glass containers on the quality of the product during storage. (BAIC #6)

Prevention of losses in yield and quality from enzymatic browning in dehydration, concentration, and freezing of fruits. Deals in part with effect of composition of sirup and volume of air space in container on appearance and storage stability of frozen fruits, particularly apricots. (BAIC #7)

Development of low-moisture dried peaches for military use. Includes the effect of oxygen, air, light, and moisture exchange on the appearance and edible quality of the product with view of applying information on proper packaging material. (BAIC #8)

I. A. (Continued)

Development of improved dehydrated products from blueberries and cranberries for military rations and essential civilian needs. Includes the effect of oxygen, air, light, and moisture exchange on the appearance and edible quality of the product with view of applying information on proper packaging material. (BAIC #9)

Development of full-flavored dried apple products, such as nuggets and powdered sauce, from Eastern grown fruit. Includes the effect of oxygen, air, light, and moisture exchange on the appearance and edible quality of the product with view of applying information on proper packaging material. (BAIC #10)

Development of a pasteurized or frozen concentrated tomato product suitable for reconstituting as a juice to conserve military storage and shipping space. Products will be in hermetically sealed containers, and, therefore, the effect of metal or glass containers on the product and its quality during storage will be investigated. (BAIC #11)

Application of dehydrofreezing to the preparation of high-quality dehydro-frozen lima beans (a concentrated frozen product affording economy in freezing storage space) for feeding of Navy personnel. Includes a study of the chemical and physical characteristics of the product as a basis for packaging needs. (BAIC #12)

Protection of dehydrated mashed potatoes (potato granules), a military ration item, against oxidative deterioration during storage, by the use of phenolic antioxidants. Includes the effect of oxygen, air, light, and moisture exchange on the appearance and edible quality of the product with view of applying information on proper packaging material. (BAIC #14)

Development of methods for preparing dehydrofrozen green beans (a concentrated frozen product affording economy in freezing storage space) for feeding of Navy personnel. Contains in part a study of the physical and chemical characteristic of the product as related to packaging needs. (BAIC #15)

Development of ready-to-eat highly nutritious rations for the armed services based on compressed potato chips. Includes the effect of oxygen, air, light, and moisture exchange on the appearance and edible quality of the product with view of applying information on proper packaging material. (BAIC #16)

Prevention of insect infestation in packaged dried fruits and nuts. Develop insect-proof packages and methods of treating these commodities during packing to insure an insect-free product. (BEPQ #2)

I. A. (Continued)

Methods of harvesting, storing and handling sweetpotatoes. Includes studies of container, time, temperature, and humidity relationships in the storage house. (BPISAE #1)

Handling, grading, and shipping southern-grown vegetable plants northward. Determine the value of synthetic latex sprays and dips in preventing wilting and/or disease development in plants in transit; investigate the use of new plant shipping containers for disease prevention and other losses to plants in transit. (BPISAE #2)

Post-harvest bacterial diseases of horticultural crops. Test and develop methods of controlling bacterial diseases such as improved handling and packing methods, and use of disinfectant washes and wraps. (BPISAE #3)

Antiseptic treatments for control of post-harvest diseases of horticultural crops. Application of fungicides to the container, liner, or packing material, value of disinfecting storage houses and containers. (BPISAE #4)

Relation of handling packing-house practices to development of post-harvest diseases of horticultural crops. Conduct experiments to demonstrate the effects of handling and packing methods, such as washing, waxing, etc., on diseases that affect fruits and vegetables after harvest. (BPISAE #5)

Problems in shipment of horticultural crops by rail. Study of the transit services offered by railroads, the performance of equipment, methods of loading, types of containers, and other factors influencing the biological or physical conditions of the transported commodities. (BPISAE #6)

Problems in shipment of horticultural crops by highway transport. Study of the transit services offered by highway transport, the performance of truck equipment, methods of loading, types of containers, and other factors influencing the biological or physical condition of the transported commodities. (BPISAE #7)

Problems in the shipment of horticultural crops by air. Develop and test packaging, containers and other methods and equipment for protection against heat and cold. (BPISAE #8)

New containers and packing methods for horticultural crops. Determines suitability of new types of containers for different commodities, how well the contents can be precooled and refrigerated in transit and storage, advantages of various methods of packing, need for paper wraps, etc. (BPISAE #9)

I. A. (Continued)

Prepackaging fruits and vegetables. Determines types of films best suited for prepackaging fruits and vegetables, study moisture loss, change in nutrition value, quality, gas exchange, disease control, need for ventilation and appearance of films. (BPISAE #10)

Prevention of mechanical damage to fruits and vegetables in handling from field to consumer. Determines the effect of the package, liner, pads, packing method on bruising of fruits and vegetables. (BPISAE #11)

Harvesting, handling, storage, and shipping effects on potatoes. Study the effect of storage environment in bin storage, 20 to 40 bushel crates, bushel crates, sacks, etc. on weight loss, storage life and culinary quality of potatoes. Conduct trials with consumer type packages. (BPISAE #15)

Cold storage of citrus fruit for off-season marketing. Study devices for increasing fruit storage life, including after-harvest treatments, wraps, etc. (BPISAE #16)

Packing and preservation of stored shelled nuts. The effect of commercial and improved packages on the storage and shelf life of shelled nuts when held at different humidities and temperatures similar to those in practice will be studied. (BPISAE #17)

Improved methods for packing, handling, and shipping peaches. Make tests of new or improved packages and their effect on bruising. Determine relationship of decay to fungicidal treatments given during packing operations and in orchards, and the value of sanitary measures in handling and packing. (BPISAE #18)

Improved wooden fruit and vegetable containers. Determine the requirements for picking boxes and for shipping containers used by fruit and vegetable growers in order to promote better utilization of forest products; improve existing designs or develop new containers that will give better performance at lower original cost; and, as regards shipping containers, reduce loss and damage claims, which increase consumer prices. (FS #1)

Improved loading methods and containers for shipping agricultural commodities. Study the adaptability of present containers to efficient methods of loading and protection of the commodity, and recommend changes in containers. Conduct special refrigeration tests to determine the effect of various containers and container arrangements and load patterns on the efficiency with which the commodities (fruits, vegetables, and animal products) can be refrigerated. (PIA #11)

I. A. (Continued)

Improved carrier handling methods and equipment. Determine cost and amount of damage to commodity and containers being shipped by rail or truck (fruits, vegetables, animal products) and how equipment or handling practice can be improved to reduce these losses. (PLA #13)

Improvement of containers for western fresh plums. Develop cheaper and improved containers in comparison with those now used. (PLA #14)

Study of the quality of stored pecans. Study relationship of drying, storage, and packaging methods to the occurrence of rottenness, moldiness and other forms of deterioration. Evaluate effectiveness of different types of bags, glass, tin, and vacuumized containers in overcoming the effects of poor storage conditions. (OES #4 - Ga.)

See also the following descriptions: PMA #3, 4, 5, & 6 under III

OES #1 (Calif.) under III

I. (Continued)

B. Animal and Poultry Products

Behavior of pork in freezer storage as related to enzymatic activity.

Study of factors affecting inhibition or acceleration of specific enzyme systems in pork such as freezing and storage temperatures, curing methods, and methods of packing including vacuum packing in tin, and inert-gas packing in tin and other materials. (BAI #1)

Behavior of lamb meat exposed to and protected from air in freezer storage.

Observe changes in lamb meat stored (1) wrapped in cellophane, (2) vacuum packed in tin plate cans, (3) packed in tin plate cans under an atmosphere of carbon dioxide, and (4) packed in tin plate cans under an atmosphere of N₂. (BAI #2)

Behavior of beef exposed to and protected from air in freezer storage.

Determine changes in beef (1) fully exposed to air in storage; (2) frozen, sealed individually in cellophane, and returned to storage; (3) frozen, dipped, and stored; and (4) packed individually in tin plate cans, sealed in vacuum, frozen and stored. (BAI #3)

Processing in relation to preservation of quality and nutritive value of meats. Study the effects of current packaging materials on quality retention of frozen and cured meats during storage from 100° F. below to 110° F. above zero. Duplication of freezer locker plant conditions of storage of fresh and cured meats, using packaging materials currently used by locker plant industry. (BAI #4)

Prepackaging of retail cuts of fresh and cured meat. Study to determine the significant biochemical changes and the role of microbial flora of meat that are involved in the deterioration of retail cuts of prepackaged meat and to devise and develop improved protective packaging methods, with or without associated means, for inhibiting or minimizing the deteriorative changes that occur in such product. (BAI #5)

Development of dry honey-milk products for use in prepared baking mixes and in highly nutritious beverages suitable for military convalescence. Includes the effect of oxygen, air, light, and moisture exchange on the appearance and edible quality of the product with view of applying information on proper packaging material. (BAIC #18)

Investigation of the extension of the storage life of frozen turkeys by use of antioxidants to retard rancidity development. Includes a study of film coating and use of gas packing. (BAIC #19)

Development of means for retarding flavor and texture changes in precooked frozen turkey meat dishes suitable for meal service where preparation time or facilities are limited (e.g., on airplanes). Includes an investigation of best sizes of meat to use and utilization of liquid and dry packs as related to packaging needs. (BAIC #20)

I.B. (Continued)

Improvement in the storage life and appraisal of health hazards of fresh cut-up poultry products by development of improved processing practices, with special emphasis on microbiological factors. Project includes influence of commercial packaging materials and/or processing methods on rate of spoilage. (BAIC #21)

Packaging of dried skim milk in consumer-size packages. To determine the efficiency of various small packages for preservation of dry skim milk, and to formulate standards for a satisfactory type of small package. (BDI #1)

Development of treatments to prevent insect damage to cured meats. Develop and evaluate wrappers or coatings, or treatments for them, to protect cured meats from insect attack. (BEPQ #4)

Improving preparation of wool for cooperative marketing. Find and develop (1) superior packages for grease wool, and (2) substitutes for the jute bags now generally used. (FCA #2)

Economic and technical problems of marketing prepackaged meat in Michigan. Determine effects of prepackaging practices on quality and color of meats and consumer acceptance of prepackaged meats and associated merchandising practices. (OES #2 - Mich.)

Effect of prepackaged meat sales on consumer demand for meat in Oregon. Compare the kinds, prices, qualities and quantities of meats sold through prepackage meat counters with that sold through regular type meat counters; test the effects of brands, grades and advertising in prepackage markets; and explore food combination sales with meat to stimulate volume. (OES #3 - Oreg.)

See also the following descriptions: PMA #11 & 13 under IA

C. Other Food and Feed Products

Development of an "instant" rice (prepared for serving by adding boiling water) for military and civilian use. Includes the effect of oxygen, air, light, and moisture exchange on the appearance and edible quality of the product with view of applying information on proper packaging material. (BAIC #2)

Stabilizing carotene (pro-vitamin A) in dehydrated alfalfa in order to assure an economical supply of this essential vitamin for poultry and livestock use during seasons of the year when green forage is in short supply. Deals with selection of suitable antioxidants for stabilizing carotene in the dehydrated alfalfa, and protective needs of the stabilized product. (BAIC #3)

I.C. (Continued)

Determination of optimal conditions of temperature and humidity for storage of dry beans and peas in order to define proper warehouse facilities for military use. Includes the effect of oxygen, air, light, and moisture exchange on the appearance and edible quality of the product with view of applying information on proper packaging material. (BAIC #13)

Stabilizing candies for use in military rations. Includes a study of incorporation of humectants, antioxidants, and emulsifying agents, and the effect of air, oxygen, light, and moisture exchange on appearance and edible quality of the product as a basis for packaging needs. (BAIC #17)

Development of insect-resistant packaging materials. Develop packaging materials for grain and cereal products that will be resistant to attack by meal moth, flour beetles, weevils, and other stored grain pests. (BEPQ #3)

Evaluation of protective packages for cereal food and food products in trade channels. The most promising treatments for cartons and fabric or paper bags developed in BEPQ project #3 will be carried into trade channels for evaluation of effectiveness under conditions of actual use in industry. (BEPQ #5)

Feed bags as an item in costs of feed to farmers. To determine the types, kinds and sizes of bags used for feed and obtain some measure of their relative importance; the extent and methods of operation of bag return programs; the necessity for and methods used in cleaning, re-conditioning and sterilizing used feed bags; the impact of bulk delivery on the bag problems; and practical methods of lowering the cost of packaging feed to the mill and to the farmer. (FCA #4)

Improvement of transportation facilities. Study results of loading methods and types of containers used for transporting farm and food products in order to reduce loss and damage in transit. (PMA #2)

Packaging to reduce discoloration of dry beans, peas, and rice. Evaluate clear and colored packaging cellophane and related films; use colored and over printed films to preserve the natural color of whole peas, split peas, dry edible beans and rice when displayed on retailers shelves under strong light; and ascertain packaging methods and materials that will prevent checking and yellowing of rice. (PMA #9)

Films for packaging dry beans, peas, rice, lentils, etc. Determine the best cellophane weights for 1, 2, and 3 lb. packages; the best film to withstand adverse weather conditions and be suitable for all automatic bag making, filling and sealing machinery; suitable transparent film for window-front cartons and also adhesives for holding the window intact; and kinds of transparent packaging materials suitable for 4 or 5-lb. packages. (PMA #10)

I. (Continued)

D. Other Products

Exploratory tests of new materials and methods for the control of insects in stored tobacco. Includes in part the evaluation of treated or insect-resistant containers for tobacco in storage or tobacco products in trade channels. (BEPQ #1)

Master containers for reducing transit damage and costs. Determine the practicability of using master containers, pallets, or unit loading methods in shipping agricultural commodities and processed foods by rail and truck to reduce transportation damage and handling costs. (PMA #12)

See also the following descriptions: PMA #7 under III.
FS #2 & 3 under II.

II. DEVELOPMENT AND EVALUATION OF CONTAINER MATERIALS

Research in this field includes: (1) development of improved and/or cheaper packaging materials through new technological processes and the use of different raw materials, (2) development of materials with special properties, and (3) evaluation of the fundamental properties of packaging materials that have general application, such as strength and insulating qualities.

Chemical survey of newly introduced or developed grain types. Project includes study to find a high-amylose starch for use in making transparent films for packaging foods for the Armed Forces. (BAIC #1)

Pilot-plant development of a wet separation process for dividing sugarcane bagasse into fiber to conserve pulpwood supply and into pith to improve marketability of molasses for feed. Includes use of bagasse fibers for making pulp, board and paper. (BAIC #22)

Development of the mechano-chemical pulping process for sugarcane bagasse and straw. Includes improvement in corrugating board for containers to meet military requirements. (BAIC #23)

Semi-commercial-scale trials of the Northern Laboratory processes for converting bagasse into boards. Project deals with making acceptable board for commercial shipping containers. (BAIC #24)

Development of the mechano-chemical pulping process for sugarcane bagasse and straw. Includes preparation of liner board to extend kraft pulp. (BAIC #25)

Evaluation of fiberboard for containers. Develop better fiberboard boxes and extend their field of utility through the correlation of the performance of the box with the strength of the fiberboard and the properties of the

II.C.-(Continued)

paperboard; develop methods of more accurately evaluating the properties of fiberboard materials for shipping containers. (FS #2)

Improving pallets. Make available to shippers and manufacturers a rational method for the design of pallets in order to bring about more efficient use of forest products. (FS #3)

Southern woods for pulp and paper. Increase the utilization of southern woods for pulp, paper, and allied products, (FS #4)

Western woods for pulp and paper. Increase the utilization of western wood species for pulp, paper, and allied products. (FS #5)

Eastern and Lake States wood for pulp and paper. Increase the utilization of these woods for pulp, paper, and allied products. (FS #6)

Uses of pulp from wood grown on the farm. Investigate the suitability of selected species of southern hardwoods (oaks) for use as corrugating and liner boards, insulating board and hardboard, roofing felt and white paper. (FS #8)

See also the following descriptions: FCA #2 under IB
FS #1 under IA

III. EVALUATION AND IMPROVEMENT OF PACKAGING OPERATIONS

Layout, equipment and operation of cheese plants. In many plants, it is customary to use each cheese vat for all operations, thus limiting production in the vat to one batch of cheese per eight-hour day. Experiments will be made in pumping the curd and whey in solution to an inexpensive curd draining vat for quick draining and fast preparation for packing into cheese hoops. (BPISAE #13)

Improved equipment and standard plans for Michigan fruit packing sheds. Develop plans for efficient packing house operations and reduce mechanical injury to fruit (apples, peaches, and pears). (BPISAE #14)

Cost of packing and packaging citrus fruits in Florida and Texas. Determine the costs of packing and handling citrus fruits in various types of containers in Florida and Texas. (A joint study with the Florida and Texas Agricultural Experiment Stations.) (FCA #1)

Cost of packaging potatoes for cooperatives. To analyze the costs and methods of packaging potatoes by producers and associations of producers as a means of developing and adopting more efficient methods and practices. (FCA #3)

III. (Continued)

Costs of preparing cotton for market and handling in marketing. Ascertain actual cost to cotton producers for ginning and packaging cotton. (PMA #1)

Prepackaging fresh fruits at point of production. Investigate the economic feasibility of prepackaging fresh fruits at point of production; determine the relationship of various prepackaging methods and related handling and merchandising practices to quality of product, cost of marketing, and market demand; assist producers, shippers and processors in the development and adoption of more efficient practices in the preparation and distribution of prepackaged fruits. (PMA #3)

Prepackaging fresh vegetables at point of production. Investigate the economic feasibility of prepackaging vegetables at point of production; determine the relationship of various prepackaging methods and related handling and merchandising practices to quality of product, cost of marketing, and market demand; assist producers, shippers and processors in developing more efficient practices in the preparation and distribution of prepackaged vegetables. (PMA #4)

Prepackaging fruits and vegetables at wholesale level. Investigate the economic feasibility of prepackaging fruits and vegetables in consumer-sized units at terminal points; to determine the relationship between various prepackaging methods and related handling and merchandising practices to such factors as quality of product, cost of marketing, and market demand; assist terminal market packers in the development of more efficient practices for preparing and distributing prepackaged produce. (PMA #5)

Prepackaging fruits and vegetables at retail level. Investigate the economic feasibility of prepackaging fruits and vegetables in consumer-sized units in self-service food stores. Measure the comparative salability and costs of direct labor, packaging materials and waste and spoilage losses of fresh fruits and vegetables prepackaged in different types, sizes and designs of containers in relation to similar produce displayed in bulk. (PMA #6)

Reducing cost of handling through use of various equipment. Measure in terms of man-hours the time required to handle different types of commodities and packages under as nearly uniform circumstances as possible without the use of equipment, by use of two-wheel trucks, four-wheel trucks, skids, pallets and fork-lifts, and conveyors and combinations of conveyors, etc. in order to measure the reduction in man-hours required for such handling. (PMA #7)

Improving marketing methods and equipment for marketing facilities. Develop work methods to increase the efficiency of labor in cleaning, grading, sizing, packing, lidding, labeling, and marking farm and food products. (PMA #8)

III. (Continued)

Prepackaging of animal and poultry products by self-service food stores. Evaluate the economic feasibility of prepackaging meat and related products by self-service food stores; assist retailers in developing and adopting efficient methods of prepackaging meat; and determine the consumer acceptance of such products. (PMA #16)

Marketing California bulk and packaged fresh vegetables. Determine advantages and disadvantages to growers, marketing agencies, and consumers of packaging fresh vegetables, factors important in setting up consumer grades for these products, and relationship between prices and quality of bulk and packaged fresh vegetables as affected by season, type of retail store, marketing channel, etc. (OES #1 - Calif.)

See also the following descriptions: FCA #4 under IC
PMA #12 under ID
OES #3 (Oreg.) under IB

IV. OTHER INVESTIGATIONS RELATING TO PRODUCTION AND USE OF CONTAINERS

Deterioration of wood and fiber containers. Determine causes, evaluate damage and devise means for preventing or delaying the deterioration of wood and fiber containers. (BPISAE #12)

Consumption and requirements of forest products for major wood uses. Determine the consumption and probable future trend in requirements for timber and other forest products such as lumber, veneer and plywood, cooperage stock, pulpwood, ties, and fuel wood, to help determine how much timber should be grown. (FS #7)

Survey of containers used for fresh fruits and vegetables. Catalogue the types and sizes of containers used for marketing fresh fruits and vegetables, and determine the extent and use of different containers. Determine the amounts and types of material used in the manufacture of fresh fruit and vegetable containers. (PMA #15)

See also the following descriptions: FCA #4 under IC.

